



## Learning Strategies Mediated by Technologies: Use and Observation of Teachers

Andrea Carvalho Beluce<sup>1</sup>  
*Universidade Estadual de Londrina,  
Londrina-PR, Brazil*

Katya Luciane Oliveira  
*Universidade Estadual de Londrina,  
Londrina-PR, Brazil*

**Abstract:** The appropriate use of digital information requires skills that enable regulation of cognitive thinking. This research is focused on building a scale that measures the learning strategies used by teachers and the ones they observe being practiced by their students, either adopting classical media technologies or the internet, besides pursuing evidence of internal consistency for such scale. Altogether, 515 teachers from Parana and Mato Grosso do Sul states in Brazil participated in the research. The first stage was focused on preparing the questions, and the second on the search for evidence of internal consistency for the Learning Strategies Used and Observed by Teachers (LSUOT) scale. The results revealed the reliability of the tool by internal structural analysis, showing its psychometric properties. It is safe to consider that the results can make contributions to teachers in the utilization and teaching of strategies that make the learning process in this current digital society easier.

**Keywords:** cognitive processes, metacognition, learning, educational technology

## Estratégias de Aprendizagem Mediadas por Tecnologias: Uso e Observação de Professores

**Resumo:** O uso adequado das informações digitais requer habilidades que possibilitem regular o processamento cognitivo. Esta pesquisa objetivou construir uma escala que mensure as estratégias de aprendizagem utilizadas pelos professores e as que eles observam que os seus alunos adotam, seja com o uso de tecnologias da mídia clássica seja *on-line*, e buscar evidências de consistência interna para referida escala. Participaram do estudo 515 professores dos estados do Paraná e do Mato Grosso do Sul. A primeira etapa tratou da elaboração das questões e a segunda investigou as evidências de consistência interna da Escala de Estratégias de Aprendizagem Utilizadas e Observadas pelos Professores (EAUOP). Os índices alcançados com a análise da estrutura interna revelaram a confiabilidade do instrumento, evidenciando suas propriedades psicométricas. Considera-se que os resultados obtidos podem trazer contribuições aos professores quanto à utilização e ao ensino de estratégias que favoreçam a gestão da aprendizagem na sociedade digital.

**Palavras-chave:** processos cognitivos, metacognição, aprendizagem, tecnologia educacional

## Estrategias de Aprendizaje Mediadas por Tecnologías: Uso y Observación de profesores

**Resumen:** El uso adecuado de la información digital requiere de habilidades que permitan regular el proceso cognitivo. Esta investigación tuvo como objetivos construir una escala de medición de las estrategias de aprendizaje utilizadas por los profesores y de las que observan que emplean sus estudiantes, ya sea mediante el uso de tecnologías de medios clásicos u *on line*; así como buscar las evidencias de consistencia interna para la referida escala. En este estudio participaron 515 profesores de los estados de Paraná y Mato Grosso do Sur. La primera etapa trató la elaboración de las cuestiones y la segunda, investigó las evidencias de la consistencia interna de la Escala de Estrategias de Aprendizaje Utilizadas y Observadas por los Profesores (EAUOP). Los índices alcanzados con el análisis de la estructura interna, revelaron la confiabilidad del instrumento y sus propiedades psicométricas. Se considera que los resultados obtenidos pueden contribuir a que los maestros comprendan y utilicen las estrategias de enseñanza que apoyan la gestión del aprendizaje en esta sociedad digital.

**Palabras claves:** procesos cognitivos, metacognición, aprendizaje, tecnología educativa

<sup>1</sup>Correspondence address: Universidade Estadual de Londrina. Centro de Educação, Comunicação e Artes. Programa de Doutorado em Educação. Rodovia Celso Garcia Cid, Km 380, s/n, *campus* Universitário, Londrina-PR, Brazil. CEP 86.057-970. E-mail: [andreabeluce@gmail.com](mailto:andreabeluce@gmail.com)

The popularization of different digital media has made both the reach and the production and socialization of information more accessible, facts that have made it possible

to establish a new culture of learning (Bartalo, 2006). In this new scenario, learning is an increasingly present need, which goes beyond the walls of the school and continues throughout life (Pozo, 2004). Researchers such as Bartalo (2006), Kiliç-Çakmak (2010), Livingstone (2011) and Pozo (2004), however, point out that access to this multiplicity of information, promoted by the so-called knowledge / learning society (Pozo, 2004), does not ensure the extension or deepening in the appropriation of the subject's knowledge.

In this sense, Pozo (2004) emphasizes that the strategic use of information in the construction of new knowledge calls for specific learner skills. To that end, it is necessary for the individual to be able to identify, select, interpret, compare, analyze and synthesize information, both in terms of strictly face-to-face teaching and in situations mediated by digital technologies in the online context (Livingstone, 2011). In terms of the technological resources used in online contexts, Kiliç-Çakmak (2010) and Livingstone (2011) evidence these skills, emphasizing the need for literacy in Internet use, or cyber literacy, that is, the student should be able to know how to make use of online information, presented in the most diverse formats, which will be truly relevant for the cognitive processing of learning and for the development of social practices, surpassing the border between informal and formal knowledge.

Studies indicate that, in the course of information processing, the understanding and adoption of some strategies make significant improvements to learning, helping the students to strengthen their perception of competence and their autonomy in decision making (Beluce & Oliveira, 2015; Perassinoto, Boruchovitch & Bzuneck, 2013). According to Perassinoto et al. (2013), there exists a range of categorizations of learning strategies, such as: test strategies, elaboration, organization, monitoring, affective, information recording, organization of the environment, search for help, self-assessment, time and effort management, among others. In general, authors such as Dembo (1994), Boruchovitch (1999) and Oliveira et al. (2011) classify learning strategies in two groups: cognitive and metacognitive.

Cognitive strategies act in the organization, storage and processing of information and are described as the strategies that help students to recover and process memory information more efficiently (Perassinoto et al., 2013). These cognitive strategies can also be specified in strategies for testing, elaborating and organizing information. Thus, test strategies design techniques for repeating or rehearsing information; elaboration strategies involve the articulations between the new and already learned content and organization strategies relate to the actions the student performs to distinguish the parts of content and to establish semantic links among them (Oliveira et al., 2011).

Metacognitive strategies are categorized into strategies for planning, monitoring, and regulating learning. Boruchovitch and Santos (2015) and Dembo (1994) consider them as more complex than cognitive strategies because they picture the students' mental actions to self-regulate their own learning. Thus, planning strategies deal with the structuring of goals to be addressed; monitoring strategies contribute to

the subject's identification and follow how effectively he / she is learning the proposed content and, finally, regulation strategies help the student recognize, analyze and intervene in study behaviors, seeking to provide and expand results that are effective for learning (Oliveira et al., 2011).

Learning strategies are sometimes mediated through classical media technologies and sometimes through online media. According to Silva (2010), classical media comprises those transmitted by technologies such as radio, printed materials (newspapers, magazines, books), television, among others, while online media is designated by its microstructural digital property, constituted bit by bit, a condition that facilitates the manipulation and transformation of information.

Veiga Simão (2004) carried out a study that presents observations portrayed by teachers about the strategies used by students to study. In the reports uncovered, teachers observed that students find it difficult to organize resources and tasks, prioritize improvisation in detriment of study planning, establish few relationships between new information / content and already appropriated knowledge and do not systematize or reflect on the cognitive steps they perform to learn.

Similar observations are found in a study developed by Monereo (1990) when reporting that when asking students to describe moments or means that occurred upon returning from school, accurate and detailed answers are obtained. However, the same does not occur when asked about strategies that have been performed to understand a text or when asked to indicate a certain amount of words related to a recently studied topic. Based on these observations, Monereo (1990), Veiga Simão (2004), Veiga Simão and Frison (2013) and Figueiredo (2016) stress the urgency of adopting teaching actions that help the student to monitor and regulate their own learning. Nevertheless, Schofield (2012) and Figueiredo (2016) report that teaching students to understand and use learning strategies is not always an easy task.

In this perspective, Veiga Simão and Frison (2013) explain that to teach the student to employ learning strategies, it is necessary, first, that the teacher also uses these strategies to learn. For the authors, teachers should use self-regulation strategies in different situations, namely, as an apprentice and in the exercise of pedagogical practice, for example: in the planning of the learning process and the classes to be taught, in the management of resources for study and for didactic purposes, in the monitoring of motivations and emotions and in the self-assessment and regulation of their actions, whether directed towards learning or referring to the implemented teaching methodology.

According to Veiga Simão (2004), strategic pedagogical actions, which seek to teach the student to think, come from teacher training that enables the teacher to act as a strategic learner. The author emphasizes that in order to teach the student to use cognitive resources in learning situations, the teacher must have experienced the learning of the taught contents in a strategic and metacognitive way. According to the author, only then will the teacher be able to observe the adequate, inadequate or even non-existent use of strategic

behaviors presented by the student while studying, as well as to make use of these observations in the planning and execution of pedagogical actions that allow this student to understand and appropriately use several strategies that favor the learning of the studied knowledge.

Although the relevance of learning strategies to the educational context is noteworthy, Cunha and Boruchovitch (2012) report that the number of studies that investigated the use of these strategies by teachers is still restricted and, for the most part, come from international literature. In recent years, studies that investigate the use of learning strategies by teachers related to different variables stand out, such as: motivation to learn (Cunha & Boruchovitch, 2012); work motivation (Santisi, Magnano, Hichy & Ramaci, 2014); understanding of metacognition for personal use and pedagogical practice (Wilson & Bai, 2010); epistemological beliefs (Belet & Güven, 2011) and academic performance (Romanowski & Rosenau, 2006, Senler & Sungur-Vural, 2014).

Among the aforementioned studies, the research carried out by Wilson and Bai (2010) stands out, which investigated teachers' understanding of metacognition related to both their own learning and pertinent to their pedagogical practice, in other words, their pedagogical understanding of the nature of what it means to teach students to be metacognitive. One of the instruments used for data collection was the TMS (Teacher Metacognition Scale), the validity and reliability of which were confirmed in this study. The study revealed that the necessary skills to teach the students to use metacognitive strategies require the understanding of both the concept of metacognition and metacognitive thinking.

Also incipient are the studies that dealt with learning strategies mediated by the use of digital technologies, mainly regarding the use of technological resources that provide access, cognitive processing and the production of information in the digital format. Among these studies are the works of: Bartalo (2006), Coiro & Dobler (2007), Tu, Shih and Tsai (2008), Tsai (2009), Kiliç-Çakmak (2010) and Tsai, Liang, Hou and Tsai (2012), who researched learning strategies with the use of digital resources to search and understand information in online situations.

Research conducted by Bartalo (2006) and Tsai (2009) explored the measuring of students' learning and study strategies, and both studies confirmed the validity and reliability of the investigated instruments. The research conducted by Bartalo (2006) adapted and used the LASSI (Learning Study Strategies Inventory) and added to the original 11 questions concerning study and learning strategies adopted in the internet. The data analysis confirmed the validity of eight of the ten subscales of the original instrument, since Self-Testing and Testing Strategies were suppressed. The results emphasized the need for strategies that contribute to the prioritization of the essential information to the study, faced with the growing online information flow. The study developed by Tsai (2009) applied an instrument that sought to evaluate the behavioral, procedural and metacognitive strategies of students when searching for information on the web. Gender differences were pointed out for behavioral and

procedural strategies and no significant difference was found for the metacognitive strategies dimension.

Learning strategies aimed at reading comprehension while reading on the internet were also investigated in a study developed by Coiro & Dobler (2007). The authors emphasize the need to investigate this topic, since the processes for reading comprehension in online situations differ from those experienced with the linear and sequential structure of the printed text, giving the reader access to a range of information that is interconnected by hyperlinks, icons, interactive diagrams, and more. For data collection, different methods were used, such as: verbal protocols, questionnaires, field observations, among others. The results revealed that successful internet reading experiences require the students to simultaneously present prior knowledge about the topic read, inferential reasoning strategies and self-regulated reading processes.

Studies developed by Tu et al. (2008), Kiliç-Çakmak (2010) and Tsai et al. (2012) also investigated the learning strategies mediated by online media technologies aimed at the search, organization and elaboration of information. The research dealt with the aforementioned strategies and their implications when related to the following variables: web experiences, epistemological beliefs and the nature of searching tasks (Tu et al., 2008); self-efficacy and literacy on the internet (Kiliç-Çakmak, 2010) and online research of informal and academic content (Tsai et al., 2012).

In light of the foregoing, it is possible to gauge the importance of studies that investigate learning strategies that favor the search, organization and processing of information, conveyed both by the classical and digital media, which will support the necessary reflection and self-regulation for the construction of new knowledge. As seen before, it becomes imperative that teachers experience the use of learning strategies in their training, since such experience is essential to performing a strategic pedagogical practice, that is, it is necessary that the teacher does not only focus on the contents to be taught, but also provides the student with the teaching of the study processes that enable the learning of new knowledge (Veiga Simão, 2004; Veiga Simão & Frison, 2013).

Therefore, it is important to consider the relevance of instruments that measure the strategies used by teachers, both in personal study moments and in professional situations in which they plan and effect educational actions. Equally important is to measure the observations these teachers make regarding the strategies their students adopt to learn, since the proper use of such observations can contribute to the teacher monitoring and evaluating their own teaching practice, seeking to implement actions that better meet the cognitive and social needs of this student's learning processes (Figueiredo, 2016, Veiga Simão & Frison, 2013, Wilson & Bai, 2010). In this perspective, this study aimed to construct and search for validity evidence for a scale that measures the learning strategies teachers use and observe their students adopt, whether using classical or on-line media technologies.

## Method

This research was organized in two stages, namely: study 1, developed to support the formulation of the questions that integrated the scale investigated; and study 2, carried out to formulate and structure the questions, send them to judges, apply the instrument and search for evidence of validity. The studies are presented next in the text.

### Study 1

#### Objectives

The aim of this first study was to meet two specific and complementary objectives. Firstly, it was sought to conduct with the teachers a survey of indications of both learning strategies they use and those they observe being practiced by their students when studying. Based on the data obtained from this survey, the aim was to categorize the collected strategies and to use them to elaborate structural questions of an evaluation scale of the learning strategies used and observed by teachers. It is explained that the categorization carried out with study 1 subsidized the elaboration of the scale developed in study 2.

#### Participants

Being an active teacher or in the training process was the main condition to select this sample. Thus, 85 teachers participated in this initial study, in the initial years of elementary school in a city of the state of Paraná, in the year 2014. The average age was 40 years and four months, the minimum age being 24 years and the maximum 59 years. There was a participation rate of 98.8% ( $n = 84$ ) for females and 1.2% ( $n = 1$ ) for males.

#### Instrument

The instrument used consisted of two questions that asked the participants to issue written answers. The first question invited teachers to indicate the learning strategies used in their personal study moments or to plan their teaching. The second question asked teachers to list the learning strategies they usually observe that students use to study.

#### Procedures

**Data collection.** The data collection, in the year 2014, involved the participants of a continuing education course for elementary school teachers in a municipal education network. At the beginning of the course, the teachers were invited to answer the questions asked in the instrument. Thus, after signing the free and informed consent form, the participants answered the questions proposed.

**Data analysis.** The data analysis performed in this study was descriptive, with a survey design. The collected data were organized in a spreadsheet and submitted to descriptive

statistics, aiming to meet the objective established for this stage. For organizational purposes, the data were grouped into two dimensions: strategies used by teachers and strategies observed by teachers.

The first dimension grouped the strategies employed by teachers, both in the personal scope, for the understanding and management of their learning, as well as for attending to professional requirements, that is, for the regulation of their teaching practice. The second dimension was grouped considering that the use of strategies for the planning and monitoring of the teaching performance should seek to observe and evaluate the strategies adopted by the students. Such actions are essential, as they provide information that makes it possible for the teacher to perform a pedagogical practice that seeks to help students to understand and regulate learning themselves (Figueiredo, 2016; Veiga Simão & Frison, 2013; Wilson & Bai, 2010). In this context, the need is justified for an instrument that integrates and measures the two dimensions that deal with learning strategies: those used by teachers and the observed ones practiced by their students.

Both categories pointed to items that enabled the grouping of sub-dimensions of cognitive and metacognitive learning strategies. Therefore, the following strategies were specified: strategies for testing, elaboration, organization and regulation of learning. It should be noted that the categorization adopted in this study was based on the research developed by Dembo (1994), Oliveira et al. (2011) and Boruchovitch and Santos (2015), who also used similar classifications for data comprehension and analysis.

#### Ethical Considerations

The development of this research was supported by National Health Council Resolution 466/12 and supplements. The participating institution was contacted and the project was forwarded to the Research Ethics Committee of the State University of Londrina, which approved and granted the necessary authorizations, according to protocol 30.520/2011.

### Study 2

#### Objectives

The objective of this second study was to construct and seek validity evidence for a scale that measures the learning strategies used by teachers and which they observe their students using to accomplish academic/school tasks. Learning strategies mediated by classic and online media resources were considered.

#### Participants

This second study also selected teachers who are active or preparing themselves for teaching practice as a condition for inclusion in the sample. Thus, 515 participants answered the instrument, namely: enrolled in courses for teachers working



in the initial years of elementary education, provided by a public education institution of the city in the state of Paraná; participants in specialization courses in the area of Education offered by a higher education institution that attends to the states of Paraná and Mato Grosso do Sul. The mean age was 40 years and 7 months, with a minimum age of 20 years and a maximum age of 64 years. The female sex represented 93.1% ( $n = 479$ ) and the male sex ( $n = 36$ ).

## Instrument

To evaluate the participants' answers, the authors used the scale of Learning Strategies Used and Observed by Teachers (LSUOT). It is worth mentioning that for the construction of the items of this scale the categorization of the learning strategies resulting from the analysis developed in study 1, previously described in this text, was used. In total, the scale includes 32 items concerning the learning strategies used and observed by the teachers, in study circumstances mediated by digital or classical media.

For the strategies employed by the teachers, 17 questions were included and, for the strategies these educators observed their students use to study, 15 items were established. The questions were elaborated on a three-point Likert scale, whose alternatives obeyed the following pattern: always, sometimes and never, scored 2, 1 and 0, respectively. The elaborated items of this scale were based on studies on learning strategies developed by researchers such as Dembo (1994), Oliveira et al. (2011) and Boruchovitch and Santos (2015). These studies categorize learning strategies in cognitive (test, elaboration and organization) and metacognitive (planning, monitoring and regulation).

It is valid to emphasize that these questions sought to express the different specificities of cognitive and metacognitive strategies, in study circumstances mediated by digital or classical media. The questionnaire developed for this research was submitted to content validation procedures, with 80% agreement among three judges. Of these judges, two were doctors, researchers on the subject of learning strategies in different teaching modalities, and one held a master's degree, with studies focused on the use of learning strategies mediated by online media. The judges evaluated the elaborated questions and issued their opinions, confirming the validation of the items' contents included in the scale.

## Procedure

**Data collection.** Data collection was carried out during the years 2014 and 2015, involving the participants enrolled in continuing education courses of elementary school teachers in a municipal school network or in specialization courses of a higher education institution. At the end of one of the classes that were part of the courses, the teachers were invited to answer the questions indicated in the instrument.

**Data analysis.** In order to meet the proposed objective of this study, the collected data were organized in a spreadsheet and underwent inferential statistical analysis (exploratory factor analysis).

## Ethical Considerations

As with the ethical considerations presented for Study 1, the present research was supported by National Health Council Resolution 466/12 and supplements. The participating institution was contacted and the project, according to the descriptions presented in protocol 30.520 / 2011, complied with the requirements of the Research Ethics Committee of the State University of Londrina.

## Results

### Study 1

The data collected were categorized and produced exploratory and descriptive results, corresponding to the frequency of the participants' indications regarding the use of the learning strategies. Data analysis for the first dimension indicated a total of 298 indications of learning strategies, of which 93.6% ( $n = 279$ ) were attributed to cognitive strategies and 6.4% ( $n = 19$ ) to metacognitive strategies. The second dimension delimited the teacher's observations regarding the learning strategies presented by students while studying. The results showed a total frequency of 176 indications of learning strategies. From this total, 70.5% ( $n = 124$ ) were found for cognitive strategies and 29.5% ( $n = 52$ ) for metacognitive strategies. Table 1 shows the frequency ratios based on the teachers' indications for both dimensions - dimension 1 and dimension 2.

Table 1

*Learning strategies used by teachers: frequency of indications*

Item	Learning strategies indicated	F	%	Type
1	Test	192	64.4	Cognitive strategies
2	Elaboration	76	25.5	
3	Organization	11	3.7	
4	Planning	0	0	Metacognitive strategies
5	Monitoring	7	2.3	
6	Regulation	12	4	

The results for dimension 1 showed that the cognitive strategies of the test type were the most indicated by the teachers. The data analysis revealed that indications such as reading ( $n = 86$ , 28.9%) and reading and highlighting ( $n = 34$ , 11.4%) obtained the highest indices among the results for this dimension. For the second dimension, the indices also showed test-type cognitive strategies as the most frequently used strategy observed by teachers. These data derive from how frequently strategies were indicated, as follows: reading of printed material ( $n = 31$ , 17.6%) and web ( $n = 12$ , 6.8%), rereading and highlighting ( $n = 7$ , 3.7 %), repetition / memorization of the information read / researched, among others.

## Study 2

To obtain the results, exploratory factor analysis was carried out, which sought to identify the dimensions that integrate the scale. The Bartlett Sphericity Test was used to verify the feasibility of applying the exploratory factor analysis, which showed the correlation between the items ( $x^2 [496; N = 515] = 2709.787; p < 0.000$ ). The Kaiser-Meyer-Olkin (KMO) test was also applied, which verified the suitability of the sample and presented an index of 0.828.

This factor analysis, which considered principal components and varimax rotation, allowed us to obtain a structure of two main dimensions for the scale, which reached eigenvalues above 1.0 and made it possible to explain 24.66% of the total variance. Thus, dimension 1 - learning strategies used by teachers, with 11 items (3, 4, 6, 7,

8, 9, 10, 11, 12, 14, and 16) was established and dimension 2 - learning strategies observed by the teachers (18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31 and 32) maintained the initial number of questions proposed for this category. Thus, the total of 26 items was shown for the scale.

It should be clarified that the varimax rotation method was chosen, since this method minimizes the number of variables that will integrate each grouping, that is, it simplifies the interpretation of the dimensions. It was also analyzed by the extraction method, which considers the analysis of the main components, and by the varimax rotation method with Kaiser normalization, the total factor loading of the scale ( $\alpha = 0.84$ ) and the factor loading of the dimension 1 ( $\alpha = 0.84$ ) and dimension 2 ( $\alpha = 0.68$ ). The other Cronbach alpha values, measured for each of the items included in the scale, can be seen in Table 2.

Table 2

*Distribution of items per dimension and their respective factor loadings*

Item	Question	1	2	Type	Total value subscale
3	Do you usually highlight the important parts of printed texts or books to plan your class?	0.514			
4	When you research to plan your classes, do you usually confront the new information with the information you have about the student's reality?	0.381			
6	When you use the web (search sites) to study or plan your class, do you try to elaborate schemes to organize the information obtained in the research?	0.422			
7	When you do research in on-line videos, do you usually pause the movie to write down the main ideas?	0.437			
8	Do you usually register reliable sites to indicate to the student when you request school research that uses the web?	0.492			
9	Do you usually rewrite a summary of the main information obtained on-line with the students?	0.504			
10	When you propose web research to the students, do you usually make lists or tables to confront the information found in different on-line sources?	0.484			
11	When you use hypertexts* for planning your classes or for teaching, do you usually register the additional information (audio, video, texts, images and others) you found when you clicked the available links? * hypertext: (digital texts that grant access to additional information through links)	0.61			
16	Do you notice it when the large amount of information and the different forms of content (video, audio, image, text etc.) available on the web contribute to you being able to relate the school contents with the student's reality?	0.373			
12	Do you usually ask for help when you notice that you have difficulties teaching certain content?	0.383			
14	When you get feedback on your planning or teaching practice, do you usually review your notes or your actions?	0.357			

Cognitive

Metacognitive

Dimension 1 – Learning strategies used by teachers

 $\alpha = 0.84$ 

continued...

continuation...

Item	Question	1	2	Type	Total value subscale
18	I usually observe that, when they read a text, the students highlight parts they consider important.		0.605	Cognitive	Dimension 2 – Learning strategies observed by teachers
19	I usually observe that the students make notes when I am teaching new contents.		0.599		
20	I usually observe that the students make drawings to express what they understood from the text read or the class.		0.552		
21	I notice that the students tend to read aloud to better understand the text.		0.448		
22	The students tend to report/express in their own words what they understood from the class or from a text read.		0.515		
23	When the students use on-line research, I usually observe that they make notes.		0.575		
24	I notice that the students usually relate the textual information obtained on the web with the school contents or with their reality.		0.594		
25	I notice that, to understand some situation/fact, the students compare the information watched in online videos with their reality.		0.565		
26	The students usually report/express in their own words what they read or watched on the web.		0.443	Metacognitive	
27	When they notice that they have difficulties understanding some contents I notice that the students ask me for help.		0.405		
28	When they execute an activity, I observe that the students notice when they did not understand the content and make new attempts in order to be successful.		0.593		
29	I notice that the students usually exchange ideas, information, experiences with other colleagues when they notice they have difficulties understanding.		0.553		
30	When they get feedback on an activity, the students usually check the right and wrong answers.		0.476		
31	When they notice that they did not understand contents available in an on-line video, I notice that the students watch the movie again.		0.526		
32	I notice that, when they did not understand some information published on the web, the students ask me or their colleagues to help.		0.512		

$\alpha = 0.68$

In line with the presented results, six questions of the total of 32 items that were included in the initial scale were excluded. The eliminated items were questions 1, 2, 5, 13, 15 and 17, which did not present a factor loading, since the minimum value adopted in this study was 0.35. Table 3 highlights the deleted questions concerning the items mentioned.

It is also pertinent to give the classifications obtained for the constituent items of the LSUOT scale. Thus, after the factorial analysis, dimension 1 - learning strategies used by teachers - presented the cognitive strategies with the following questions: 3, 7, 8 and 11, integrating the strategies of test; items 4, 9 and 16 dealt with strategies of elaboration and questions 6 and 10 represented strategies of organization.

Questions such as “Do you usually highlight the important parts of printed texts or books to plan your class?” and “When you use the web (search sites) to study or plan your class, do you try to elaborate schemes to organize the information obtained in the research?” integrated the cognitive strategies. The other items in this category, 12 and 14, dealt with the regulation strategy (“Do you usually ask for help when you notice that you have difficulties teaching certain content?”), belonging to the category of metacognitive strategies.

Regarding the dimension 2 - Learning strategies observed by teachers - the cognitive strategies were grouped with questions 18, 19, 21 and 23 (“When the students use on-line research, I usually observe that they make notes”) for the

strategies of test, and 20, 22, 24, 25 and 26 for the strategies of elaboration (“I notice that the students usually relate the textual information obtained on the web with the school contents or with their reality”). Metacognitive strategies, in turn, were

represented by items 27, 28, 29, 30, 31 and 32 (“When they notice that they have difficulties understanding some content, I notice that the students ask me for help”), which dealt with issues consistent with strategies of regulation.

Table 3  
*Excluded Items and their Respective Questions*

Item	Question	Dimension	Type
1	Do you usually highlight the important parts of the text proposed for reading with the students?	1	Test
2	When you read something new, referring to your didactics, do you relate it with your current teaching practice?	1	Elaboration
5	Do you usually express aloud what you understood from a text you are studying or intend to teach the students?	1	Test
13	In planning your classes, when you notice that you’re reading something you did not understand, do you usually pause and reread the text?	1	Regulation
15	Do you usually exchange ideas, information, experiences with other colleagues when you notice you have difficulties planning a class or teaching content.	1	Regulation
17	When you notice you have difficulties teaching some content, do you seek answers by typing your doubt on online search platforms?	1	Regulation

## Discussion

The results obtained in this research were based on the analysis of data from two studies. Study 1 provided the necessary support for the formulation of the questions that made up the Learning Strategies used and Observed by Teachers (LSUOT) scale, an instrument that was elaborated, applied and evaluated in the course of study 2. In study 1, the indices related to the frequency of indications presented by the participants corresponding to the learning strategies, both used by the participants themselves and those they observed their students to use, were raised.

Regarding study 2, the results indicated that the psychometric properties of the LSUOT scale, elaborated and proposed by the authors of this study, can be verified. The reliability of the instrument was evidenced, through analysis of the internal structure. The Cronbach’s alphas of the constituent dimensions of the scale were also measured and considered acceptable. These indices allow the described scale to be recommended as a diagnostic measure in psychoeducational research that aims to evaluate questions concerning learning strategies, mediated by classical and online technologies, both used by teachers and observed to be used by their students in study situations.

The factorial analysis of the scale also resulted in the suppression of items 1, 2, 5, 13, 15 and 17, since these questions did not present a consistent index of factor loading. The suppressed items integrated Dimension 1 of the scale and most of these questions represented metacognitive strategies, regulation-type, mediated by classical media technologies. It is presumed that these items presented problems in their formulation, a fact that may have compromised the participants’

interpretation of the question. It is also necessary to consider as a hypothesis the difficulty in measuring metacognitive strategies more precisely, due to their complexity, as already pointed out in the studies developed by Veiga Simão and Frison (2013) and Beluce and Oliveira (2016).

It should be noted, however, that other items in the scale also represented this construct and, possibly, the writing of these questions provided participants with a better understanding of the presented proposal. Nevertheless, it is valid to point out that, even so, the results obtained with study 2 demonstrated that the lower values of alpha, in both dimension 1 and 2, occurred in questions that expressed metacognitive strategies by regulation. Therefore, it is necessary to perform future studies to submit the above-mentioned questions to a detailed content analysis that will allow a refinement of the psychometric properties pertinent to these items.

The analysis of the data from study 2, which dealt with dimension 1, also indicated the teachers’ preference in the use of cognitive and metacognitive learning strategies mediated by technological resources from classical media. These results are related to the knowledge presented by the teacher pertinent to digital technologies and learning strategies (Alvarenga & Azzi, 2013; Cunha & Boruchovitch, 2012). For Alvarenga and Azzi (2013), teachers’ knowledge regarding the use of digital technological resources in the mediation of the educational process is still considered incipient, a fact that compromises the belief of these professionals in their competence in making effective use of these technologies in teaching activities or in situations directed to their own formation. It is also believed that this initial condition about the knowledge relevant to these resources may have hindered proficient understanding of the items proposed in the scale.



Also regarding the interpretation impairment of the predicted questions, it is worth noting the similar notes made by Cunha and Boruchovitch (2012), pertinent to the teachers' knowledge about learning strategies. The authors report that the knowledge concerning the use of these strategies by the educators is in an initial phase and, in general, is superficial or inadequate. These results, once again, highlight the need for revision and textual restructuring of questions, especially those dealing with metacognitive strategies and the items related to the use of strategies mediated by online media technologies. Subsequent investigations using this scale are considered essential, to provide additional information and to illustrate in a didactic and objective way the functionality of online media resources in the educational context, and also to bring the concepts and applicability of cognitive and metacognitive strategies, increasing to the participants the possibility of performing a conducive interpretation of the evaluated subject.

In conclusion, it is worth mentioning the limitations inherent in the scale as to its constitution by self-report items. As already pointed out by Perassinoto et al. (2013) and Veiga Simão and Frison (2013), the use of self-report scales to measure learning strategies is quite frequent among national and international researchers. However, as stated by Perassinoto et al. (2013), self-report structures allows situations in which the participant can indicate answers that do not express the truth about the presented actions or, even select items considered socially desirable, omitting the actual behavior. Due to these characteristics of self-report, it should be pointed out for future research that additional methods for evaluating the strategies investigated in this study are applied concurrently to the proposed scale.

The dynamic flow of information, provided by current technologies, ensures a large and diverse amount of information. However, such characteristics are not a guarantee of deepening or building new knowledge. According to the presented discussions, the effective use of these informational sources requires new cognitive skills that allow the student to convert the information transmitted, often in a chaotic and diffused way, into ordered knowledge that allows the construction of importance and meaning to the new knowledge.

In this perspective, it becomes even more important to measure, understand and use learning strategies that allow both the teacher and the student to monitor and regulate the organization and cognitive processing of this information. In view of the foregoing, this study provided evidence of internal consistency of the LSUOT scale, confirming that the instrument met the current psychometric criteria. This scale can be useful to teachers as an instrument of diagnostic measurement that favors both the understanding of their own learning and the necessary observation of the strategies employed by the student, providing information for teaching actions that lead students to exercise their learning in a more autonomous and self-regulated way.

However, it is recommended that future research overcomes the limitations presented in this study. With

regard to these limitations, the restructuring of the phrasing of some items is recommended, aiming to achieve a higher value for the indices of internal consistency of the constituent questions of the scale, especially those related to the metacognitive strategies used by teachers and mediated by the online media technologies. Also regarding the mentioned questions, it is possible to emphasize that significant results can be achieved with later investigations that are intended to review this item's content, objectifying an adequacy and refinement of the psychometric properties of the scale.

Relevant implications can be measured with studies that aim at an evaluation of the scale and its relationship with variables relevant to learning and teaching, such as: motivation, online literacy, school / academic procrastination with the use of digital technologies, performance, among others. It is estimated that the results raised with this study encourage reflection and encourage new research pertinent to the scientific advance of this theme. Therefore, as a final consideration, it can be considered that these results are expressive, since they can contribute information that deepens the knowledge of teachers and psychologists concerning strategies that give the student the necessary autonomy to regulate their own learning in the midst of the informational multiplicity of this digital society.

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Andrea Carvalho Beluce is a PhD student in the Doctoral Program in Education of the Universidade Estadual de Londrina.

Katya Luciane Oliveira is a PhD Professor of the Doctoral Program in Education of the Universidade Estadual de Londrina.

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